

REMARKS

Claims 1, 3, 5 and 6 are pending in this application. By this Amendment, claim 7 is canceled. No new matter is added.

In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

I. Objections

The Office Action objects to claim 7 under 37 CFR §1.75 as being a substantial duplicate of claim 1. By this Amendment, claim 7 is canceled, thus the objection is moot. Reconsideration and withdrawal of the objection are respectfully requested.

II. Rejection Under 35 U.S.C. §103

The Office Action rejects claims 1, 3 and 5-7 under 35 U.S.C. §103(a) over U.S. Patent No. 5,962,343 to Kasai et al. ("Kasai") in view of U.S. Patent No. 6,221,118 to Yoshida et al. ("Yoshida") in view of U.S. Patent No. 4,942,697 to Khaladji et al. ("Khaladji"). Applicants respectfully traverse the rejection.

By this Amendment, claim 1 recites, *inter alia*, "A method for polishing a glass hard disk platter, comprising polishing a glass hard disk platter using a stable slurry in which cerium(IV) oxide particles having an average secondary particle size of 0.1 to 0.5 μm ..." Kasai, Yoshida and Khaladji fail to teach or suggest at least the above features of claim 1.

The Office Action asserts that Kasai discloses polishing glass substrates with a surface modified cerium oxide abrasive slurry that comprises a particle size range that encompasses the claimed range. Office Action, page 3. The Office Action further asserts that it would have been obvious to one having ordinary skill in the art to have selected the overlapping portion of the range disclosed by Kasai because overlapping ranges have been held to be *prima facie* obvious. *Id.* Applicants respectfully assert that the following data shows

improved properties and unexpected results of the narrowly-claimed secondary particle size compared to the broad particle size range of 0.005 μm to 5 μm as disclosed in Kasai.

Comparative Example 1, beginning on page 14 of the specification, shows an example that utilizes commercially available cerium oxide powder that has an average secondary particle size of 1.4 μm , which is above the 0.5 μm maximum of the claimed average secondary particle size. Thus, Comparative Example 1 shows a case where the average secondary particle size of the cerium oxide is above the maximum in the claimed range but within the range of Kasai. As can be seen from a comparison of Examples 1-4, which utilize cerium oxide powders having average secondary particle sizes within the claimed range, and Comparative Example 1, the polishing speed, average surface roughness and ratio of polishing speed to average surface roughness are superior when the average secondary particle size is within the claimed range. See specification, page 15, Table 1. Thus, Comparative Example 1 provides evidence that when the average secondary particle size is above the maximum claimed particle size (0.5 μm), the polishing speed, average surface roughness and ratio of polishing speed to average surface roughness are not optimized.

Further, Applicants submit the following additional Comparative Test, which shows the results of a method for polishing a glass hard disk platter that utilizes a stable slurry in which cerium (IV) oxide particles having an average secondary particle size smaller than the minimum claimed value (0.1 μm).

A 500-liter glass-lining reactor was charged with 44.3 kg of pure water and 94.8 kg of aqueous 25% ammonia solution corresponding to $\text{NH}_3/\text{Ce}^{3+} = 6$ (molar ratio), and 3 Nm^3/hour of nitrogen gas was blown therein through a resin nozzle while keeping the liquid temperature at 30°C. Then, 508.0 kg of an aqueous cerium (III) nitrate solution, having a concentration of 7.84 wt% in terms of CeO_2 , was gradually added thereto over 30 minutes to obtain a suspension of cerium (III) hydroxide. The temperature of the suspension was then

elevated to 85°C. Thereafter, the gas to be blown through the resin nozzle was switched from nitrogen to 4 Nm³/hour of air, and the oxidation reaction for converting cerium (III) to cerium (IV) was started. The oxidation reaction was completed in 5 hours. The liquid obtained after the completion of the oxidation reaction was returned to room temperature to obtain a reaction mixture containing white fine particles have a pH = 9.2.

The reaction mixture was washed using a rotary filter press (manufactured by Kotobuki Giken Co., Ltd.) to obtain 172 kg of a white slurry having a solid content of 23.2 wt%, pH = 9.1 and an electric conductivity of 40 μS/cm.

The observation of the washed slurry with Transmission Electron Microscopy (TEM) revealed that the slurry contained particles from 40 to 80 nm. Furthermore, powder X-ray diffraction measurement of the product by drying the resulting fine particles revealed that the particles contained 99.5% cerium in terms of oxides in the total rare earth elements in the abrasive, and that the particles had characteristic peaks that coincided with the characteristic peaks of crystalline cerium (IV) oxide of cubic crystal form having a diffraction pattern with main peaks at diffraction angles $2\theta = 28.6^\circ$, 47.5° , and 56.4° and described in ASTM Card No. 34-394.

In addition, the specific surface area value of the cerium (IV) oxide particles, measured by a gas adsorption method (BET method), was 30 m²/g, and the particle size was 28 nm when calculated from the specific surface area by the gas adsorption.

Further, the obtained particles were measured for average secondary particle size using a centrifugal particle size distribution measuring apparatus (CAPA-700, manufactured by Horiba Seisakusho Co., Ltd.). As a result, the particles were revealed to have an average secondary particle size of 0.40 μm. To 110 kg of the washed slurry, 10 wt% of nitric acid aqueous solution was added so as to become a molar ratio of (HNO₃)/(CeO₂) of 0.5, and the concentration was adjusted with pure water to obtain 117 kg of an acid sol having a solid

content of 20.1 wt%, pH = 4.8, an electric conductivity of 39 $\mu\text{S}/\text{cm}$, and a viscosity of 1.9 mPa·s.

350 g of the acid sol and 1217 g of zirconia beads of $\phi 0.5$ mm were charged in a sand grinder having a volume of 700 ml, and ground by rotating the stirring blade at 1000 rpm for 3 hours. The resulting sol had a solid content of 21.1 wt%, pH = 5.1, an electric conductivity of 1500 $\mu\text{S}/\text{cm}$, and an average secondary particle size measured with a centrifugal particle size distribution measuring apparatus (CAPA-700, manufactured by Horiba Seisakusho Co., Ltd.) of 0.080 μm . A sol having CeO_2 concentration of 5 wt% was prepared by adding pure water to the sol obtained above.

As a glass hard disk, a 3.5-inch aluminosilicate reinforced glass substrate composed of 77.9 wt% of SiO_2 , 17.3 wt% of Al_2O_3 , and 4.8 wt% of ZnO was used. The substrate was subjected to primary polishing and had an average surface roughness of 7.3 Angstroms (\AA).

An artificial leather-type polyurethane abrasive cloth (POLITEX DGTM, 38 ϕmm , manufactured by Speedfan Co.) was applied to the platen of a LAP MASTER LM-15 grinding machine (manufactured by LAP MASTER Co.) and polishing was performed by pressing the surface to be polished of the substrate against the abrasive cloth under a load of 11 kPa. The number of rotations of the press platen was 45 revolutions per minute and the amount of the abrasive slurry fed was 10 ml/minute. After the polishing, the product obtained was taken out, washed with purified water and then dried. From a decrease in weight, the polishing speed was obtained. The average surface roughness (R_a) of the polished surface and the ratio polishing speed to average surface roughness obtained were as follows.

Polishing Speed (nm/minute)	Average Surface Roughness (Å)	Ratio (Polishing Speed/Average Surface Roughness · minute)
10	2.5	40

The results above, when compared to the results found in Table 1 of the present specification, show that an abrasive composed of cerium oxide having an average secondary particle size of 0.08 μm , less than the claimed range but within the range of Kasai, has a very slow polishing speed and a low ratio of polishing speed/average surface roughness.

Secondary particles are present in an abrasive in which the primary particles are aggregated. These secondary particles exert polishing effects in the abrasive liquid. When the secondary particles collide with the surface to be polished, a part of the secondary particles (aggregated particles) are destroyed and divided into primary particles. The relationship between polishing speed and average surface roughness is determined based upon this effect. When the secondary particle size becomes larger, the polishing speed becomes higher, but the average surface roughness of the polished surface also becomes larger. Therefore, the secondary particle size of the cerium oxide determines the polishing properties. When the secondary particle size becomes too large, the polishing speed becomes higher, but the average surface roughness of the polished surface also becomes larger. Thus, the secondary particle size of the cerium oxide particles determine the polishing properties of the abrasive, and the claimed secondary particle size range of from 0.1 to 0.5 μm provides a good balance of polishing speed and average surface roughness.

Applicants respectfully submit that Kasai fails to disclose that the secondary particle size can or should be adjusted to control the balance of the polishing speed and the average

surface roughness. Therefore, Kasai fails to provide any reason or rationale for one of ordinary skill in the art to have selected the specifically claimed secondary particle size range of 0.1 to 0.5 μm from the broad disclosure of 0.005 to 5 μm of Kasai, and that the claimed range provides unexpected results of improved polishing speed and average surface roughness. Accordingly, it would not have been obvious to one of ordinary skill in the art to have selected the claimed secondary particle size from the broad disclosure of Kasai and, thus, Kasai fails to teach or suggest each and every feature of claim 1

Further Yoshida and Khaladji, individually or in combination, are not applied to address the above discrepancies of Kasai as to claim 1. The Office Action applies Yoshida as disclosing that ceria polishing solutions are known to be used to polish magnetic discs. The Office Action applies Khaladji as disclosing that it is advantageous to use a high-purity starting material when forming a cerium oxide slurry. Therefore, neither Yoshida nor Khaladji are applied as disclosing that the secondary particle size can or should be adjusted to control the balance of polishing speed and average surface roughness and, thus, Yoshida and Khaladji fail to address the above discrepancies of Kasai. Accordingly, Kasai, Yoshida and Khaladji fail to teach or suggest each and every feature of claim 1.

Claim 1 would not have been rendered obvious by Kasai, Yoshida and Khaladji, individually or in combination. Claims 3, 5 and 6 depend from claim one and, thus, also would not have been rendered obvious by Kasai, Yoshida and Khaladji, individually or in combination. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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